Honoring Veterans . . . . 5

## Inside . . .




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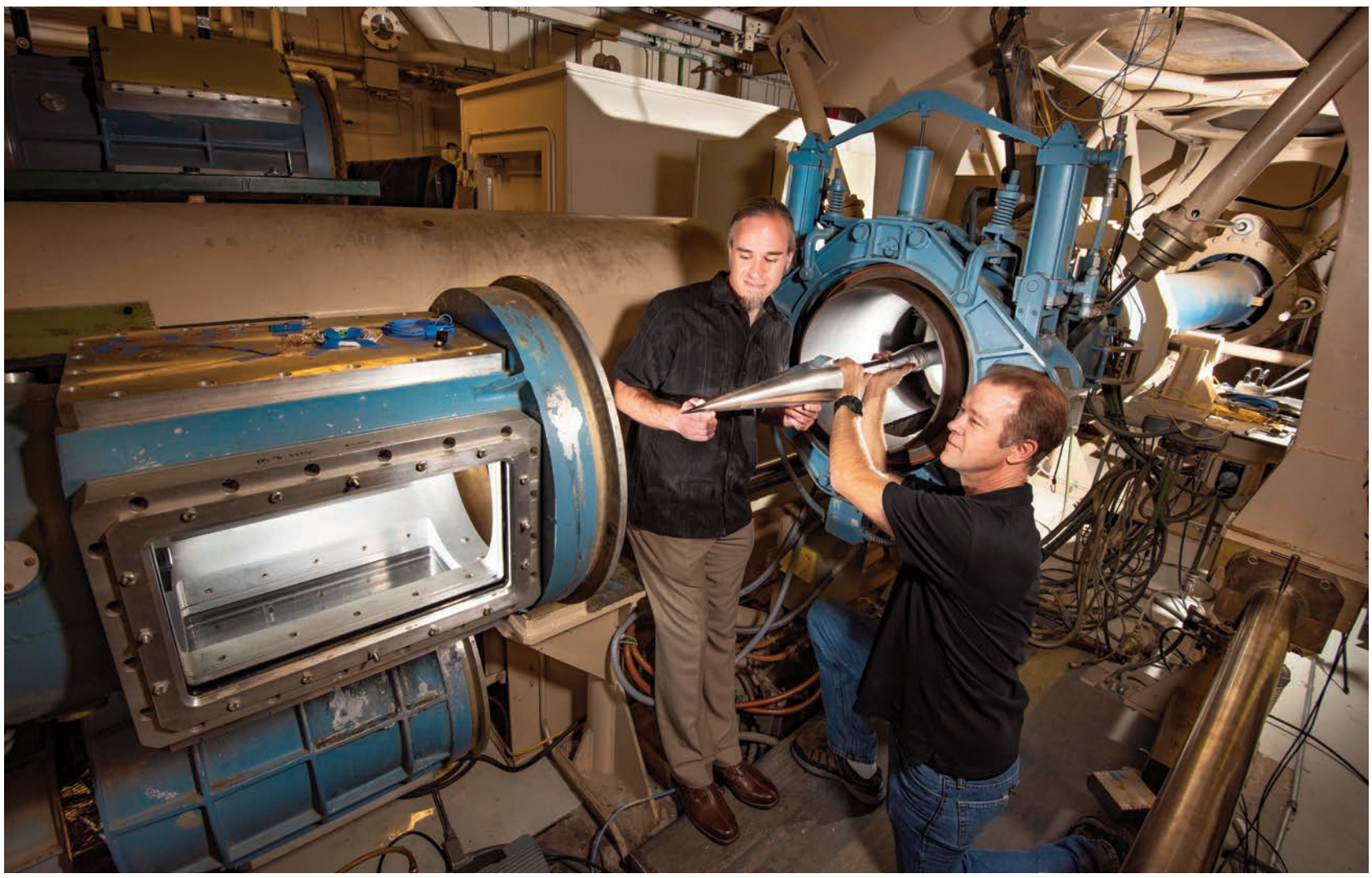
SandiaLabNews
Vol. 70, No. 22
Nov. 9, 2018
*Managed by NTESS LLC for the National Nuclear Security Administration*

MACH SPEEDS — Aerospace engineer Steven Beresh (left) and technologist Russell Spillers of Sandia aerosciences place a model in the hypersonic wind tunnel's test section. (Photo by Randy Montoya)

# Wind tunnel and lasers give nation a hypersonic proving ground

***By Michael J. Baker***
***Photos by Randy Montoya***

It's about speed, and Sandia, with a hypersonic wind tunnel and advanced laser diagnostic technology, is helping U.S. defense agencies understand the physics associated with aircraft flying five times faster than the speed of sound.

With potential adversaries reporting successes in their own programs to develop aircraft that can be flown at Mach 5 or greater, U.S. development of autonomous hypersonic systems is a top defense priority.

That priority has made aerospace engineer Steven Beresh of aerosciences and his colleagues at Sandia's hypersonic wind tunnel popular as of late.

"Before, the attitude was that hypersonic flight was 30 years away and always will be," said Steven, the lead wind tunnel engineer. "Now with the national needs, it needs to be tomorrow. We're becoming very busy."

## Cold in the tunnel

There's a whoosh of air, then a rumble followed by an electrical hum. It lasts about 45 seconds as air blows down the tunnel to a vacuum at speeds of Mach 5, 8 or 14, depending on pressure settings. The Mach 5 nozzle uses high-pressure air (nitrogen plus oxygen). Nitrogen alone is used at the higher speeds and can be pressurized to 8,600 pounds per square inch. For comparison, recommended pressure for a car tire is around 35 psi. There is so much potential energy the nitrogen must be stored in a bunker behind 1-foot-thick walls.

A model — usually shaped like a cone, cylinder or

*(Continued on page 8)*

# Nuclear Deterrence strategy confronts an uncertain global future

## Strategy aligns with Labs-level priorities to innovate and counter threats

***By Michael J. Baker*** ***Photos by Rebecca Gustaf***

The words "forward," "advancing" and "agile" were heard often as Sandia leaders presented the Labs' Nuclear Deterrence strategy to continue delivering a safe, secure and effective deterrent in the face of an uncertain global future.

But the word spoken most was "engagement," as leaders urged the Sandia workforce to participate fully in the strategy and move the Labs forward.

The Nuclear Deterrence strategy is a core part of the Labs' overall strategy to succeed for the next several decades, said Deputy Labs Director Dave Douglass, encouraging Sandia staff to "think big ideas."

"We want to get out of incremental thinking," he said. "We want to challenge ourselves to change the world."

The strategy and specific implementation plans were delivered during a Nuclear Deterrence all-hands meeting on Oct. 31 at Steve Schiff Auditorium.

"This is day one of a path forward," Associate Labs Director and Chief Engineer for Nuclear Weapons Steve Girrens said. "You've been doing a lot of work already. Now, we're going to put the hammer down."

## Five objectives forward

Kent Meeks, program director for Sandia's Nuclear Deterrence portfolio, presented the basics to those in the auditorium and hundreds more via videoconferencing at

*(Continued on page 7)*

HAMMER DOWN — Associate Labs Director Steve Girrens (right) addresses a crowd at the Nuclear Deterrence all-hands, saying it is time to put the hammer down in implementing the Labs' Nuclear Deterrence strategy.

# The One Plane Air Force and its Sandia connection

**Editor's Note:** This Veterans Day offering from Curtis M. Kaliiaa of cyber security, who is the principal investigator for Sandia's tribal cyber infrastructure work, salutes a B-29 crew and their lonesome missions over Japan in April 1945. The crew's exploits were chronicled six months later in Sparkler Comics (1941-1954) and reprinted here. The co-pilot, John Bertrand Keliiaa, was Curtis's dad.

A SALUTE TO LT. GENE FLEWELLEN of Big Springs, Texas, pilot of the Experiment Perilous, and his crewmen for the tale of their lone bombing raids on Japan. It has become one of the Pacific Air Forces legends.

Perhaps, hats should go off to the weatherman, as well, for had he not played tricks on the courageous group, the legend might never have been started.

It was on the night of the air fire attack on Tokyo, April 16, 1945, that the Experiment Perilous left its base with the rest of the raiders. Running into clouds and terrific wind, the plane got separated from its formation. When the clouds finally broke, the navigator informed the pilot that they were about 200 miles off the shore of Japan and about 250 miles from Tokyo – the target.

"We held a sort of vote, and all of us said we might as well go on up to Tokyo, even though it was pretty late," Flewellen, the 23-year-old pilot said.

As they approached the city, the crew could see fires raging below them. "They were beautiful fires – you could see them for 60 miles – and the smoke was coming up to 15,000 feet," the bombardier added. The B-29s before them had done their job well.

Tokyo's lights had been turned on again, moreover, so late was the Experiment Perilous in reaching its target. "We headed on a northwesterly course across the city," according to Flewellen, "and the lights went off again."

Of course, the crew had no way of knowing that a plane was circling far above them – a plane containing a brigadier general charting the fires made by the bombs of the earlier planes. As the lone raider dipped through the searchlights and dodged the scattered ack-ack fire, the general watched with admiration and grim amusement.

Dropping their bombs just outside the fire area, the crew was pleased to see that each bomb landed "nicely." One of the crew noted, "There were two explosions and flames shot up to 2,000 feet. There wasn't much flak, maybe eight or 10 bursts below our level."

When all the bombs were unloaded, the Experiment Perilous maintained a course toward Iwo Jima to refuel.

The story does not end there, however. In the early morning of April 27, 1945, the Experiment Perilous was flying toward Kyushu for a "milk run" attack on the airfields. Again it ran into bad weather. Even before reaching the planes' assembly point for going into the target, the crew lost track of the other B-29s due to the heavy group of clouds.

"We tried to climb and get out of them, then we headed north," Flewellen said. "We went clear up to the northwest corner of Kyushu, a distance of 160 miles from the original target.

"Then we started back down from the coast, looking for targets. All of a sudden we saw land. It looked like Nagasaki (Japan), but the city itself was closed in, so we began to make a run on a nearby town."

Luckily, the clouds broke before the run had gotten underway. Below could be seen not only the sprawling city of Nagasaki, but its great port as well, and milling around the port were more than 100 vessels, most of them small.

One large ship began twisting and turning, smoke billowing from her funnel. As the Experiment Perilous veered down for a run across the docks, the big ship suddenly stopped, apparently undecided what course it should take. The bombardier began letting loose the bombs. Watching from his position, one of the gunners could see that the blows were "sweet!" The explosions in the dock areas were terrific.

Yet there was no anti-aircraft fire. Evidently, the Japanese were taken completely by surprise!

Wheeling around, the huge plane heads south toward its base. After several hours had passed, Lt. Flewellen put the Experiment Perilous down in Saipan, with only ten-minutes of gas left in his tanks.

**39th Bomb Group, Crew 49, City of Cleveland OH, Experiment Perilous, 44-69768**

Kneeling, left to right: 1st Lt. John B. Keliiaa Pilot, 1st Lt. Gene H. Flewellen Airplane Commander, 2nd Lt. Warren E McDowell Radar Observer, F/O Theodore "Ted" J. Kalenterides Flight Engineer. Standing, left to right: Sgt. Hubert L. Benson Right Gunner, Sgt. Houston T. Putney Left Gunner, Sgt. Edgar E. Winstead CFC Gunner.

### Footnote by Curtis Keliiaa:

My dad, who was from Gardnerville, Nevada, a Washoe Tribe member and Native Hawaiian, went on to graduate Phi Beta Kappa, three-year special student status, from the University of California, Berkeley. In 1961, while he was the Bureau of Indian Affairs superintendent at the Jicarilla Apache Reservation in Dulce, New Mexico, Stewart L. Udall, then secretary of the interior, nominated him for the Arthur S. Flemming Award, which honors outstanding federal employees. Dad was a semifinalist, and while in Washington, D.C., before the proceedings were finished, he died unexpectedly of a first and fatal heart attack on Jan. 7, 1962, at age 38. My mom, Lenora Scott Keliiaa, Cherokee Tribe, from Proctor, Oklahoma, went on to her own distinguished career with the Bureau of Indian Affairs. She raised five of us, and she is the reason I landed on my feet, but that's another story. I continually strive to honor them with my dedication to service in the national and native interest. Thanks Mom and Dad, with a big salute to the courageous crew of the Experiment Perilous.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Livermore, California 94550-0969
Tonopah, Nevada • Nevada National Security Site
Amarillo, Texas • Carlsbad, New Mexico • Washington, D.C.

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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Classified ads . . . . . 505-844-4902

Published on alternate Fridays by Internal & Digital Communications Dept. 3651, MS 1468


## Autumn in the IPOC parking lot — Photo by Randy Montoya

# $H_2$AWSM: Cool cars, more fueling stations

## Sandia celebrates National Hydrogen and Fuel Cell Day

*By Jules Bernstein*

The molecular formula for hydrogen is $H_2$, but recently, Sandia celebrated the first element on the periodic table as No. 1 for its ability to provide a clean, efficient power source.

Sandia/California's event was one of many across the country held to mark the fourth National Hydrogen and Fuel Cell Day, held annually on Oct. 8 as a nod to hydrogen's atomic weight of 1.008.

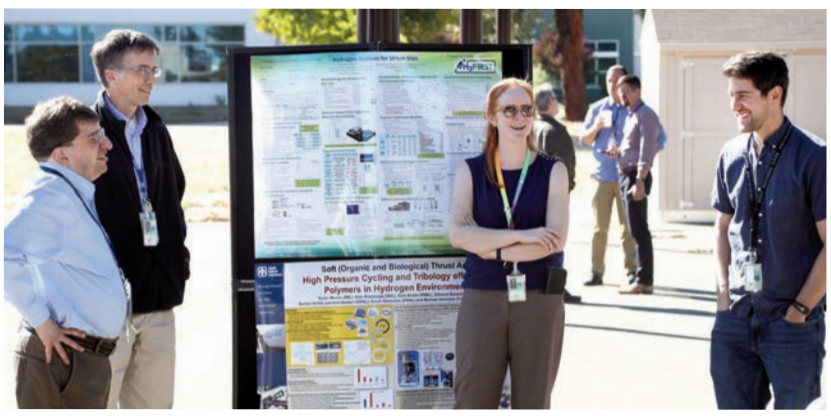
The occasion offered an opportunity to highlight Sandia's advanced research involving hydrogen fuel and to showcase the ways Sandia's work impacts transportation energy at the national level.

Scientist Ethan Hecht presented a poster about the Labs' partnership with the National Renewable Energy Laboratory that seeks to fit larger-capacity hydrogen fueling stations for vehicles into space-challenged urban areas such as San Francisco or New York City.

Although only 5,000 or so hydrogen fuel cell cars ply U.S. roads, hydrogen fueling stations are in short supply, and demand is increasing. To meet that demand, retailers are switching from gaseous to liquid hydrogen because liquid is denser, so they can store more of it in the same amount of space.

"One of the big roadblocks for liquid hydrogen storage is the 75-foot setback distance required by current fire codes between building openings and air intakes," Ethan said. "If you draw a 75-foot circle around your system, it starts to be a pretty big footprint." That's why the H2FIRST team is doing safety modeling to figure out whether the footprints can be reduced through novel configurations of station components.

Illustrating the desirability of cars powered by fuel cells, Lawrence Livermore materials scientist Tadashi Ogitsu brought his own Honda Clarity for attendees to check out. Ogitsu has had the car for over a year, and says he loves to drive it.



H2 CREW — From left, Jon Zimmerman, Chris Moen, Myra Blaylock and Ethan Hecht. (Photo by Jules Bernstein)


DRINK HIS EXHAUST — Lawrence Livermore materials scientist Tadashi Ogitsu (right) brought his hydrogen fuel-cell powered Honda Clarity for celebration attendees to check out. Ogitsu likes to remind people the only exhaust from his vehicle is water. (Photos by Jules Bernstein)

"It's very quiet. There's no transmission, so it's super smooth, and I can make it from Dublin, California, to Yosemite on one fill up," Ogitsu said.

Ogitsu, who works on hydrogen production from water via advanced high and low-temperature electrolysis, says he would not hesitate to get another fuel cell car the next time he is in the market for a vehicle.

Sandia hydrogen and fuel cells program manager Jon Zimmerman called the celebration a success.

"It helped raise our coworkers' awareness of fuel cell vehicles as an option that, in California, is here now. There are more than 35 hydrogen fueling stations throughout the state, and vehicles are available for purchase or lease from several traditional car companies," he said. "This once-futuristic vision has become a reality, in part due to the work done at Sandia."

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CaliforniaNews

# Sandia hosts next generation of nuclear experts

*By Jules Bernstein*
*Photos by Randy Wong*

ALF MORALES, manager of Sandia's Exploratory Engineering Solutions department, speaks to the next generation of nuclear non-proliferation experts.

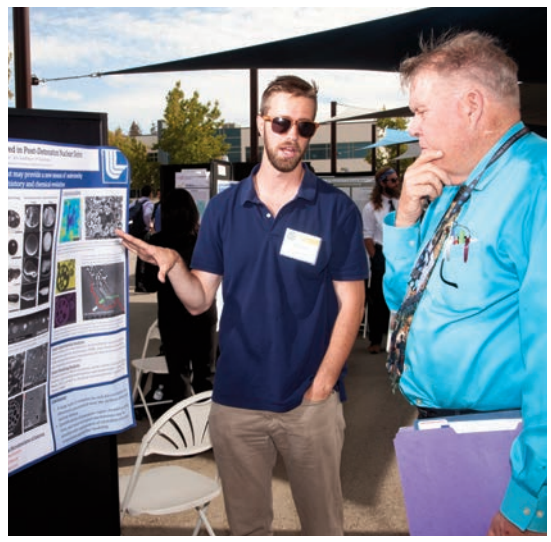
Seven years ago, NNSA established a consortium of universities and laboratories to train the next generation of nuclear security experts. This year Sandia/California hosted the group's fall workshop and advisory board meeting.

The Nuclear Science and Security Consortium, led by the University of California, Berkeley, brings together professors, researchers and students at 10 universities with experts from Sandia, Lawrence Berkeley, Lawrence Livermore, Los Alamos and Oak Ridge national laboratories. The consortium's goal is to prepare scholars for leadership roles at the national labs.

A total of 105 people attended the event. Highlights included an update on NSSC accomplishments, student oral presentations and a poster session, as well as reports by consortium focus area leads.

Associate Labs Director Dori Ellis welcomed attendees to Sandia and spoke about the history of the laboratories. Director Anup Singh and manager Alf Morales hosted the event, which gave NNSA officials a chance to see how close collaborations between the national labs and academia are successfully preparing future nonproliferation professionals.

Since its founding, the NSSC has provided nearly 400 students and postdoctoral scholars with hands-on training in nuclear science, technology and policy. Board members include former Sandia/California vice president Mim John and Sandia's Benn Tannenbaum.



TIMOTHY GENDA (left) a graduate student from UC Berkeley, shows off his work to John Taylor, an NSSC Advisory Board member and retired Sandia staff member.

NUCLEAR SCIENCE AND SECURITY CONSORTIUM — Participants in the 2018 NSSC fall workshop and advisory board meeting pose on the Sandia/California campus.

# Marines, to MMA, to subcontract manager

## *Matt Leyva shares career path that led to Sandia*

***By Manette Newbold Fisher***

It has been an adventurous road to Sandia for Matt Leyva, one that includes service in the Marine Corps, a professional fighting career and acting as a stuntman in movies filmed in New Mexico.

"I've definitely had some cool jobs in my life," Matt said.

As long as he can remember, Matt, who is a subcontract manager in Supply Chain, said he knew he wanted to take after his dad and join the Marines.

"We grew up with it our whole life," he said. "As kids he used to call me and my brothers Devil Dogs, and I never fully understood it, but when I got older, I kind of just knew. I wasn't ready to go to college right out of high school. I had scholarship opportunities, but I wanted to go and do something different."

At 18, he joined the Marines and was in boot camp for just over a month when 9/11 happened. He said everything changed that day.

"We were all there for a reason. We wanted to serve and do our part, but when that happened, there was an actual mission about to take place," Matt said. "We knew our lives were going to change at that point. We didn't know exactly how, but we were going to be ready for whatever was going to be thrown our way."

Matt was stationed in Japan for two years and deployed throughout southeast Asia. When he came back to the U.S., an East Coast unit was looking for two volunteers from the West Coast to deploy to Iraq. Matt said when he got the notification, he responded immediately as the first volunteer.

While serving overseas, Matt looked forward to receiving recorded VHS tapes from his brother of the first season of the Ultimate Fighter TV show every couple of weeks. A former member of West Mesa High School's wrestling team, Matt became interested in martial arts in the Marines. In inter-unit challenges and tournaments, he kept winning.

Matt started thinking about next steps and decided to leave the Marines to give fighting a shot. He trained in Albuquerque at the Jackson/Wink MMA Academy and went pro, compiling an 11-3 record.


SUPPLY CHAIN SUBCONTRACT MANAGER Matt Leyva stands by the War on Terror Kiosk at the New Mexico Veterans' Memorial in Albuquerque. Prior to working at Sandia, he served as a Marine for six years, was a professional fighter, and a stuntman in films shot in New Mexico. (Photo by Randy Montoya)

Following his MMA career, Matt noticed a newspaper story about casting for military personnel to try out for "Lone Survivor," the Mark Wahlberg film based on a mission in Afghanistan. He said he showed up and was hired to play a Navy SEAL on the spot. Since 2012, he has worked as a stuntman on about 35 productions shot in New Mexico, including the films "Transcendence," and "Shot Collar." His roles involved military action and fight scenes, and jumping out of vehicles.

"Basically anything they needed, I was willing to do," he said.

During that time, Matt also earned a bachelor's in criminal justice and an MBA from the University of Phoenix. After that, he said, one thing led to another and he came to Sandia. He says varied experiences help in his latest career.

"Every job can be stressful at times," Matt said. "I have a unique set of experiences that allows me to work well under pressure."

Looking back, some of his proudest moments were from the Marines, and although he's not on active duty anymore or in the reserves, Matt said he misses the Marines every day.

"Once a Marine, always a Marine," he said. "It means a lot to carry that title the rest of my life, knowing that I did make a difference. I love this country more than anything, and I was pretty proud to be able to say that I did serve it."

# New strategy helps triple Labs veteran hires


VETS SEEKING VETS — A group of Sandia employees at the 2018 Service Academy Career Conference in San Diego, California. Attending conferences is part of a new veterans hiring strategy. From left, Brian Abelgas, quality assurance specialist; Jeffrey Black, electronics engineer; Matthew R. Lewis, manager; Ariella Walker, systems engineering; John Williams, former veterans recruiting specialist. (Photo courtesy of Matthew R. Lewis)

***By Manette Newbold Fisher***

The number of military veterans hired at Sandia tripled in fiscal year 2018 and marked the highest veteran hiring rate in the history of the Labs.

As part of a broader Laboratories recruiting strategy, Sandia engaged in a new, deliberate and strategic military veteran hiring initiative that paid off.

Sandia hired about 240 military veterans between Oct. 1, 2017, and Sept. 30, 2018, a total of about 13 percent of all hires, said David Martinez, recruiting manager. Last year, Sandia hired about 70 veterans, a total of about 5 percent of all hires.

The initiative was a joint effort among the Talent Acquisition group, Diversity and Inclusion, Human Resources, the Senior Leadership Team, the Military Support Committee and volunteers, many of them veterans, David said.

"Veteran hiring is a tremendous opportunity for the Laboratories as we pursue excellence in our missions," said program champion and Associate Labs Director Michael Burns. "They have dedicated themselves to national security, have tremendous teamworking skills, have proven success in a myriad of skills needed bythe Laboratories, and often possess applicable security clearances."

The Department of Labor's Office of Federal Contract Compliance established a military hiring goal of 6.7 percent of all people hired, David said. The last time Sandia met the goal, which is not a federal requirement, was in 2015.

"It takes a vibrant community to get these kinds of results, and this has been a Labswide effort. We've had a lot of support, engagement and focus," David said.

### Veteran recruiting initiative takes shape

"In the broadest sense, hiring more veterans brings diversity of perspective, experience and skills to the Labs," David said. "Diversity is an essential element of Sandia's workforce and it needs to be a vital part of our future. Veterans are an essential part of that."

While Sandia has long worked to recruit military veterans, David said no formal strategy was in place until early February, when the hiring initiative began. When the new strategy was presented in early May, Sandia was at about 5 percent, or 60 hires, for the year, David said. Four months later, Labs' records were broken.

"When I learned we had increased our veterans hiring by such a high margin, I was thrilled," said senior manager Carol Manzanares. "Our veteran hiring strategy will be vital to our ability to meet the current and future workforce needs of Sandia."

The strategy includes several areas of focus.

The first is local engagement. Sandia works with Kirtland, Cannon and Holloman Air Force bases, the White Sands Missile Range, and the 1st Armored Division in El Paso, Texas. The Army National Guard and Reserve are represented throughout New Mexico, as well as a large veteran population who retired or separated from the military.

National reach involves Sandia teaming with other military sites outside New Mexico seeking to place talent. Each military branch has a service academy and all service men and women graduate with a bachelor's degree in a STEM field. Some military members later obtain master's degrees and doctorates and most have security clearances and years of applicable technical and leadership experience. At job placement conferences across the country, veterans look for employment after individual service commitments are satisfied. Sandia recruiting specialists partnered with service academy alumni who work at the Labs to attract veterans and attend such conferences.

Finally, through academic focus, the initiative puts recruiters in touch with colleges that have resource offices that assist veterans with academic goals. Veterans often have previous education, experience and clearances as well. Sandia recruiters worked with these offices and attended the annual Student Veterans of America Conference.

"Sandia can provide veterans the prospect of continued contributions to the nation in an exciting technical environment that has long been associated with the military community," Michael said. "We hope to be an employer of choice for veterans, and I am proud of the team that worked on Sandia's new strategic veteran hiring initiative and its success."

# Sandia celebrates Veterans Day 2018

## Photos by Randy Montoya

Hundreds of Sandia veterans and their families were honored at an annual Veterans Day Celebration on Nov. 5 that included a coin ceremony and special guest speaker Jack R. Fox, Secretary of the New Mexico Department of Veterans' Services. All service members were recognized during the Sandia Singers' performance of service songs for each branch of the military.

Fox (pictured below) emphasized the service and sacrifices New Mexicans made during World War I and highlighted the 100th anniversary of Armistice Day, which marked the signing of an agreement to stop fighting near the end of the war on Nov. 11, 1918. In the U.S., Congress changed the name of Armistice Day to Veterans Day in 1954.

**—Manette Newbold Fisher**


# First-ever Innovation XLab takes energy storage research, technology to investor community

## *Sandia attends DOE's first-ever Innovation XLab commercialization and innovation of energy technologies*

***By Mattie Hensley***

A Sandia team attended DOE's first-ever Innvation XLab — an event targeting the commercialization and innovation of energy technologies. This particular Innovation XLab focused on energy storage, an essential tool for a reliable, resilient, and flexible power grid and electric vehicles.

Private companies, investors, universities, national laboratories, government officials and other organizations convened at SLAC National Accelerator Laboratory Sept. 18-19 to showcase and view the broad array of technical resources available from across DOE's national lab complex that can be leveraged by industry to address energy storage challenges. Representatives of the private companies and investor communities also shared their needs and perspectives relative to energy storage technology and innovation in the future.

"It's a first-of-its-kind event focused on innovation and technology transfer," said senior manager Mary Monson. "DOE is going to the investor community, not just inviting companies to attend." She said she particularly enjoyed the keynote provided by Steve Westly, founder and managing partner of the Westly Group, who had served on the secretary of energy's advisory board representing the venture capital industry. "The talk emphasized the rapid, global changes across the energy and transportation sectors," Mary explained. "He focused on energy production and consumption forecasts, such as the increase in electric vehicles, to illustrate how the future — in a way — is here. And he challenged the national labs to see their part in that future and to be a part of making it happen."

Sessions ranged from discussions about how to unlock the potential of energy storage (presented by General Electric's Energy Storage CEO) to a live-streamed fireside chat including Paul Dabbar, the DOE undersecretary for science.

Associate Labs Director Dori Ellis attended the event where several Sandians contributed, including Babu Chalamala, manager of energy storage.

"We gave a good impression of what the labs have," Babu explained. "We had good interactions, good discussion with the audience."


Babu Chalamala, Carol Adkins, Jeffrey Nelson, Mary Monson, Cliff Ho, and Charles Hanley stop by Sandia's booth at the first-ever Innovation XLab held in September. For the event, the booth featured Sandia's work in energy storage and information on how to partner with the laboratories.

Jeff Nelson, senior manager, contributed to Lab Technology Pitches, working with Los Alamos National Laboratory to pitch how advanced polymer membrane technologies could enable the next generation energy economy. The pitch was one of five lab pitch presentations on high-potential beyond Lithium technologies during one of many break-out sessions during the event.

Mary joined a panel on how to engage with the DOE national labs on IP and tech partnerships. The panel addressed myths and surprises associated with the process.

In tandem with the summit, DOE announced that it plans to provide $120 million over five years to renew the Joint Center for Energy Storage Research, a DOE Energy Innovation Hub devoted to advancing battery science and technology, led by Argonne National Laboratory. JCESR, of which Sandia is a partner, was established in 2012 to establish transformative materials for batteries.

The summit also heralded the announcement of 10 new projects to extend grid energy storage. Under the ARPA-E DAYS (Duration Addition to electricitY Storage) program, the projects "will develop energy storage systems to provide reliable, affordable power to the electric grid for up to 100 hours, enhancing grid resilience and performance," according to a DOE news release.

The next summit will be held in Seattle and focus on the electric grid. Those who have grid technology or research to highlight, should contact Mary at mamonso@sandia.gov.

# Laboratory Operating System one year on — progress through learn-apply-reflect

*By Sheina MacCormic*

In just over a year, the Laboratory Operating System has developed into a valuable addition to how Sandia's workforce innovates, communicates, improves and delivers its work. The LOS team works with partners from across the Labs to improve how work is done and Sandia's mission goals are met.

The LOS is a lean system made up of processes, tools, behaviors and thinking used together. The LOS team organizes the system into six enablers: strategy deployment, data-driven and visual management, tiered accountability, problem solving and continuous improvement, user-centered design and velocity innovation development.

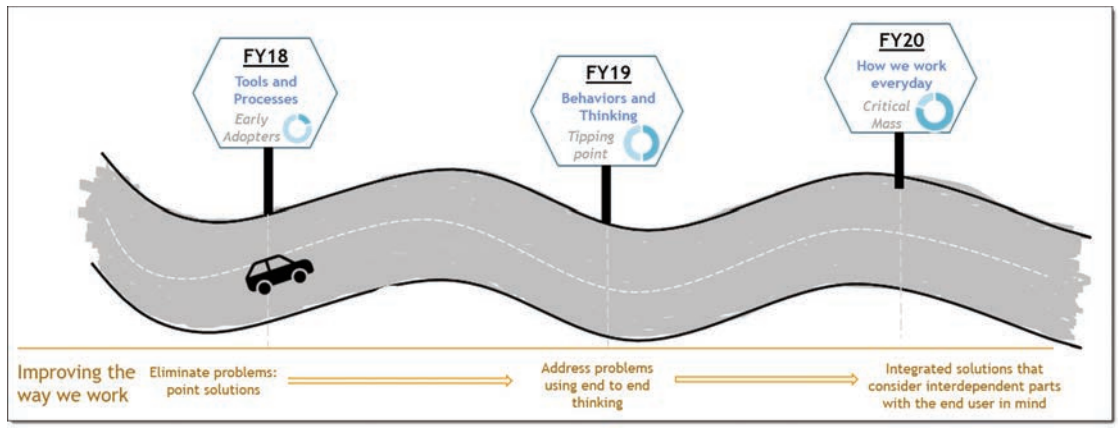
Sandia faces a rapidly changing environment with a surge in requests to meet national security needs, which is behind the need for the system. Deploying LOS helps Sandia to increase the speed and flow of mission delivery.

*"Our department began using the tiered accountability board to replace weekly department huddles. Since the (contract) transition, the department has enjoyed a streamlined meeting that facilitates review of key topics that are important to each department member and management."* **— Fred May, from technical assessment**

The system's implementation is dynamic, team members say, with constant iteration and improvements based on a learn-apply-reflect approach that results in a system that works specifically for Sandia.

## Learn

One vital element is learning about and incorporating best practices across the Labs. Although LOS is based on the Honeywell operating system, the team completed a benchmark study across technology, manufacturing and other commercial sectors and across NNSA, particularly the National Security Campus at Kansas City and the Savannah River Site, extracting key nuggets for use at Sandia. The team calls it an informed blend of research, application and iteration to refine the elements in the Labs' LOS toolbox.




## Apply

Each of the six LOS enablers includes tools, processes and behaviors applicable to daily work. Over time, using the enablers brings new thinking and behaviors, resulting in improvements, according to the team. The inaugural year has included efforts to establish a useful infrastructure through the LOS website, trainings and other presentations. They planned phased application of the enablers, so tiered accountability and user-centered design received the strongest focus during 2018.

Tiered accountability is a regular occurrence of brief, structured stand-up team meetings using a visual tier board, physical or online. Tier meetings allow all members of the workforce to see more easily what is going on in their group and obtain useful flow-down information from other tiers.

The goal is to help staff feel engaged and empowered to act and communicate for continuous improvement and align work internally as well as externally toward the broader organizational mission. The implementation of tiered accountability has evolved since the first boards were set up, and today there are more than 1,000 organizations participating.

For the first year of user-centered design, the team looked at how others implement similar tools and thinking to quickly identify problems and improve the users' experience. One approach they tested in July was a workshop that adapted successful Honeywell materials and customized it for use at Sandia. At each of 10 such workshops, they saw immediate results — actions participants could implement as well as eliminate 50 specific issues or problems. The biggest benefit they saw was solving problems with empathy for the user. Team members say it's not days in a room, it's hours, with a clear take-away.

Although the LOS infrastructure, tiered accountability and user-centered design were the major focus this year, the team applied the other four enablers to 25 projects in seven divisions. They also trained more than 225 students in lean principles to improve how day-to-day work is executed so that Sandia can realize results in support of the mission.

## Reflect

Reflection is part of any successful continuous improvement effort, permitting a better understanding of what works and what doesn't. The LOS team reviews and reflects on feedback from a diverse set of sources, including direct observations, workshops and focus groups and insights gleaned from the LOS Steering Committee, coalitions and the Lean Six Sigma community.

The team uses a structured approach to receive and act on feedback, the after-action review, which seeks answers after each event or activity: What was supposed to happen? What did happen? What did we learn? What are we going to do differently next time? The review is a quick way to ensure continuous learning and a set of actions for the next iteration of work, according to the team. Such feedback helps make the system better.

*"The user-centered design process allowed everyone to see outside of their own experience and appreciate the needs and experiences of all involved."* **— Karen Reeder, from supply chain**

At the end of each quarter, the team assesses what is working well for customers and what could be improved, which is a standard artifact of the agile/scrum process used by the team.

This fiscal year LOS team members are working with problem solvers across Sandia to recognize and share improvements. As the system matures, it will be applied more often and become more visible Labswide.

A wide range of resources and tools are available to help every group apply and benefit from the Laboratory Operating System. For more information, visit the LOS website, los.sandia.gov, or email the team at los@sandia.gov.

# Kenneth Armijo wins UNM Zia award

*By Kristen Meub*

Sandia mechanical engineer Kenneth Armijo, who leads bilingual family science events by night and researches solar energy and assists small businesses by day, received the prestigious Zia Award from his alma mater, the University of New Mexico.

"I feel pretty honored to get the award," Kenneth said. "It's pretty special in the sense that we've had a longstanding family connection with UNM, and to get basically one of the highest awards you can get there is pretty awesome."

Kenneth was honored for his community service and professional achievement. He has volunteered through Sandia's MANOS program for the last five years to put on science nights ("Noche de Ciencias") for students and their parents. The events are held in both English and Spanish and focus on getting students and their parents interested in STEM and showing the importance of staying in school.

"We show the students fun stuff with engineering and science, and folks from UNM talk to the parents about the importance of doing well in school and going on to college," Kenneth said. "Sometimes students will drop out of school to help their families by getting a job, but we try to show them that by pursuing an education and career in STEM they could have even more potential to help their families in the long run."

Kenneth has also volunteered with DreamBuilders, a program through the National Hispanic Cultural Center that hosts science, technology, engineering, art and math (STEAM) workshops for students, parents and teachers.

"At one of the workshops we focused on material sciences/chemical engineering, aesthetics and business plans by talking about how to make cosmetics," Kenneth said. We had an enthusiastic and clinically-inclined volunteer from Clinique come, and the kids were begging not to leave so they could make more lip balm and other items. We also had an event that paired occupational therapists discussing heart health with flamenco dancing as a form of art and healthy movement."

Kenneth also serves on the STEM board for the UNM-Valencia campus and volunteers at UNM and other universities through Sandia's community involvement program, helping with resume and professional development workshops.

At Sandia, Kenneth works on concentrating solar power in the areas of advanced molten salt test systems, solar reactors and materials testing, as well as photovoltaics/nuclear energy arc-fault research.

TOP LOBO — Mechanical engineer Kenneth Armijo poses with Alexis Tappan after receiving UNM's prestigious Zia award. (Photo courtesy of Kenneth Armijo)

Additionally, he has led several New Mexico Small Business Assistance program projects during the last three years. One project is helping Mother Road Canning Company in Albuquerque optimize their mobile canning line for better throughput, to add nitrogen into their canned beverages.

"This has been a really fun project," Kenneth said. "It's a lot of computational fluid dynamics work that we've previously used for energy research, but now we are applying it in a different way for a local company that cans a variety of beverages."

UNM president Garnett Stokes presented Kenneth with his award at the annual All University Breakfast and Awards Presentation in late September.

"We are proud to honor our 2018 Lobo, Zia and Inspirational Young Alumnus award recipients for their tremendous accomplishments that have made significant positive impacts on their communities," said Dana Allen, vice president of UNM Alumni Relations and executive director of the Alumni Association. "The awards celebrate these outstanding individuals and the significant contributions they've made to the university, our city, state and country."

# SANDIA CLASSIFIED ADS

**Note: The Classified Ad deadline for the Nov. 23 issue of the Lab News will be Thursday, Nov. 15 at noon instead of Friday, Nov. 16. This deadline change applies to this issue only.**

## MISCELLANEOUS

SCOUT CARGO/UTILITY TRAILER, small, w/hitch, bracket for cooler/tool box, $350; generator 3110-W, $700. Willmas, 505-907-9324.

PRIVACY SCREEN/ROOM DIVIDER, w/plantation shutters, 3, 22" x 72" panels, dark brown, perfect condition, $150. Giese, 332-8212.

STAND MIXER, Sunbeam, chrome, stainless bowl, w/attachments, $50; KitchenAid K45 mixer, white, stainless bowl, w/attachments, $75. Garner, 505-269-3350.

LEATHER COUCH, wine color, paid $1,000, asking $500 OBO; Toshiba flat screen TV, w/glass stand, paid $1,300, asking $300 OBO. Willis, 505-304-5034.

ACOUSTIC GUITAR, Oscar Schmidt, OF3, seldom played, original case, 3rd nut slips, needs work, $30 OBO. Curtis, 505-280-0534.

YOUNG AT HEART CHRISTMAS MARKET/CONCERTS, Nov. 30-Dec. 1 and Dec. 7-8, 8401 Paseo del Norte. Martin, 281-7227.

POOL/PING PONG TABLE COMBO, 7' x 4', w/sticks & paddles, great condition, $125. Babilonia, 505-554-4420.

DVDS, various movies, full list & prices at https://goo.gl/zci4kU. Wood, 228-0193.

CHRIS ISAAK TICKETS, 2, Dec. 1, Isleta Casino, zone B, seats H22-H23, $45 ea. Smith, 505-259-9713.

COFFEE TABLE, pine wood, Southwest custom made, 52"L x 21"W x 18"H, sanded, ready for refinishing, $80. Yazzie, 505-220-1139.

FOOD MANDOLIN, Shun Pro, all accessories, retail $400, asking $100, call or text for photos. Hanks, 249-1931, ask for Ben.

DINING TABLE, Thomas Queen Anne style, mahogany, 44" x 72", 2 leaves, 6 mahogany chairs, excellent condition. Hogue, 797-2861.

TIRE CHAINS, for radial, bias, bias belted tires, like new, fits 185/R15, 195/R14 or R15, P195/75R15 or similar, $10. Kepler, 291-3448.

RAIL LIGHT, 9-ft., Tiella, w/5 white glass pendants, new, original, in pkg., $150. Stubblefield, 263-3468.

EXTREME 4-BASS, Schecter 2500 Stiletto, $300; Behringer Ultrabass, BXL900, 90-W amp, $150; hardly used, $400/both. Kral, 505-410-9599, text or call.

SLATE POOL TABLE, Olhausen Americana, 7-ft., accessories & 3.5-in. overhead light fixture, $950. Grossman, 856-2096.

USED DRYER, 2004 Whirlpool, works great, just don't need 2 dryers, you pick up, free. Walsh, 366-3771 or 259-9180.

## How to submit a classified ad

**DEADLINE:** Friday noon before the week of publication unless changed by holiday.

Submit by one of these methods:
- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 505-844-0645
- MAIL: MS 1468 (Dept. 3651)
- INTERNAL WEB: Click on the News tab at the top of the Tech-web homepage. At the bottom of the NewsCenter page, click the "Submit a Classified Ad" button and complete the form. Questions to Michelle Fleming at 505-844-4902.

Due to space constraints, ads will be printed on a first-come, first-served basis.

## TRANSPORTATION

'03 Z06 CORVETTE, manual, 6-spd., always garaged, millennium yellow, original owner, 44K miles, great condition, $19,900. Haddock, dobieranchdad@me.com.

'11 ACURA MDS, AWD, seats 7, black, leather, tech & entertainment pkgs., clean Car Fax, 97.5K miles, great condition, $14,900. Sherwood, 505-355-9931.

'05 TOYOTA HIGHLANDER, 2WD, V6, 3rd row, hitch, 130K miles, good condition, $5,500. England, 602-738-0308.

## Ad rules

1. Limit 18 words, including last name and home phone (web or email address counts as two or three words, depending on length).
2. Include organization and full name with ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. The same ad may not be run more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees only.
10. Housing listed for sale is available without regard to race, creed, color, gender, sexual orientation or national origin.
11. Work wanted ads are limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in poor taste.

'95 DODGE DAKOTA, 4x4, V8, original owner, mostly renovated, new paint, must see, 116K miles, $5,600. Potter, 505-610-9933.

'10 SUBARU OUTBACK 3.6R, blue, new tires, navigation, Bluetooth, runs great, garaged, <49K miles, $10,000. Nagel, 506-9478.

'13 RAV4, AWD, limited, loaded, new tires, battery, 46K miles, terrific condition, great value, $17,500. Clem, 505-379-0475.

## REAL ESTATE

4-BDR. HOME, 2-1/2 baths, 2,810-sq. ft., South Valley, new flooring, upgrades galore, shed, nice sized backyard, $239,000. Michael, 505-595-4469.

3-BDR. HOME, 2-1/2 baths, 2,148-sq. ft., many updates, 0.99 acre, $329,000. Wise, 505-514-5011.

2 ACRES, Sandia Park homesite, level, square lot, near road to Sandia Crest, mountain views, utilities, new road, easy terms, $120,000. Mihalik, 505-816-8469.

## WANTED

HANDYMAN, experienced, credibly referenced, for next few weeks or months in small condo, 87111. Greene, 505-508-0094.

OCCASIONAL OR DEDICATED COACHING, FOR 501(c)3 high school boys lacrosse team, Westside Lacrosse. Britt, britts@comcast.net.

# Nuclear Deterrence

*(Continued from page 1)*

Sandia's other sites.

"It's preparing for a long-range global future," Kent said. "It's a way to look out to inspire us" for the next 10 to 20 years. The Nuclear Deterrence strategy is based on five evolving objectives, plus a cross-cut focus on people, facilities and technology. The five core objectives are:

• The Foundation — Nurture and advance Sandia's science and engineering foundation through innovation.

• Flexible and Responsive (Sustained) Deterrence — Strengthen the U.S. deterrence posture in an uncertain and changing global environment.

• Nuclear Enterprise Assurance — Ensure research, design, development, production, testing, storage, packaging, transportation, maintenance, surveillance, dismantlement and disposal for current and future weapons are resilient to subversion.

• Integrated Weapon and Physical Security — Create solutions based on intelligence-informed threat assessments that provide security for U.S. nuclear weapons throughout their lifecycle.

• Stockpile Evaluation and Assessment — Drive agile, sustainable, forward-looking assessments of U.S. nuclear weapons safety, security and effectiveness through engagement and application of Sandia's broad capabilities.

## Rubber, meet road

"Enough talking about this," Steve said. "Let's start thinking about implementation."

Directors and managers also presented detailed plans about what is occurring and what will occur at Sandia to meet each objective.

Terry Aselage, director of material, physical and chemical sciences, presented The Foundation objective, explaining how research, testing, computing platforms and advanced analysis can help meet the Labs' mission. High-performance computing, the Z Machine and additive manufacturing, among other technologies, will help propel Sandia forward, he said.

Colin Smithpeter, with advanced weapon systems and surety, presented the Nuclear Enterprise Assurance objective. He spoke of the growing global threats to nuclear deterrence and the need to continue working with the Labs' national security partners to deter and detect those threats.

"The threat is present and quickly evolving," he said. "We need to broaden our defenses. … Let's see what we can do to deter an adversary from the very beginning."

Matthew Brown, in critical cybersystems, gave specifics for objective owner director Dave Corbett on Integrated Weapon and Physical Security, speaking to Sandia's unique position to provide leadership in security solutions that address real-time threats. Integrated security allows Sandia to address the security challenges in the Nuclear Posture Review, he said.

STRATEGY SESSION — A crowd at the Steve Schiff Auditorium listens as the Labs' Nuclear Deterrence strategy is outlined at an all-hands meeting.

Sandia's broad capabilities are critical in maintaining an agile and forward-looking assessment of U.S. nuclear weapon safety, security and effectiveness, said Chris O'Gorman, New Mexico stockpile systems engineering, addressing the Stockpile Evaluation and Assessment objective. Experimentation and "bringing all the tools we have to bear at Sandia" offer innovative approaches to improving the product, he said.

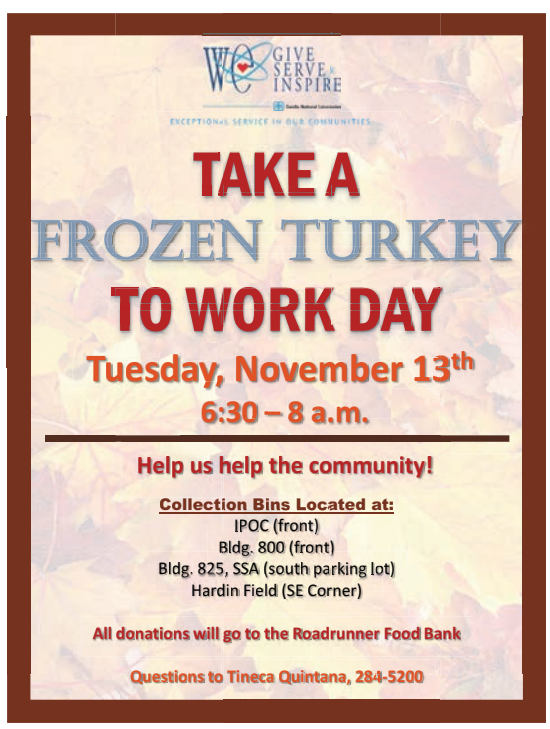
Sandia must accelerate the agility of the development cycle, reduce uncertainty in the understanding of the threat and increase innovation with broader participation across the Labs, said Scott Holswade, director of advanced systems and transformation, in presenting the Flexible and Responsive (Sustained) Deterrence objective.

"We want to strengthen our deterrence posture in an uncertain and rapidly changing global environment," he said. "If you have a badge at Sandia, you're part of the weapons program."

## Seek more information

Speakers urged all members of the workforce to seek more information and opportunities to get involved in the Nuclear Deterrence strategy — beginning with a poster session in the auditorium lobby — to gain a fuller understanding of current projects and how they fit into the objectives.

"We need everybody to get involved here," Steve said. "Our future is at stake."



# Wind tunnel

*(Continued from page 1)*

tailpiece replica of what might be used with flight vehicles — is placed in the tunnel's 18-inch diameter test section. By necessity, the model, 4 to 5 inches in diameter, is not an exact replica of the full-scale version but can handle a variety of instruments, geometry changes and spin testing. Part of the wind tunnel engineer's job is to understand those scaling issues.

Inside the test section, temperatures can get extremely low, so electric resistance heaters unique to each Mach number heat the gases and prevent condensation of the gas. Without heat, the air or nitrogen turns to ice in the wind tunnel. The heaters essentially work like very large hair dryers — 3-megawatt hair dryers — that can raise the air temperature above 2,000 degrees Fahrenheit at the beginning of the tunnel. By the time air or gases get to the test chamber, the temperature can fall as low as minus 400 degrees Fahrenheit.

## Physics at hypersonic speeds

When discussing Sandia's contribution to hypersonic research, Steven refers to solving the "hypersonics problem," which is basically trying to grasp the physics of how air flows over an object at speeds greater than Mach 5.

"The physics are enormously difficult at hypersonic speed," Steven said. The air and gases react differently than at subsonic speed; materials are at extreme temperatures and pressure; and there is the added challenge of ensuring guidance mechanisms withstand the pressures.

"We have some information, but not enough information," he said. "We've mostly been dealing with reentry vehicles. Before, the idea was to just have the vehicle survive; now, it needs to thrive. We're trying to fly through it."

A major strength of hypersonic research at Sandia is the team of people. "To really make an impact in hypersonic research, it requires a collaboration between people who understand the hypersonic vehicle, people who understand the fluid dynamics, people who understand the measurement science and people who understand the computer simulations," said Daniel Richardson, a mechanical engineer in diagnostic sciences. "That's how you can begin to understand the underlying physical phenomena."

## Marriage of measurements

"It's the marriage of these measurements with the wind tunnel capabilities that gives Sandia its national niche," Steven said. "And you've got to have people who can do both working together."

"Sandia has been at the forefront of developing new measurement techniques," Daniel said. "We're always pushing to improve measurement capabilities."

Sandia is using advanced lasers to measure the speed of the gases passing over the model, direction of air flow, pressure and density of the gases and how heat is transferred to the model.

"Sometimes it's about how close can you get to the surface of the object to see how gases are reacting at that speed," Daniel said. "Not just in front of the model but behind it. The ultimate goal is to measure everything, everywhere, all the time."

## Freezing time

A laser aimed through the test section's rectangular window allows the light coming in to measure the air flow inside. In recent years, new measurements have become possible with the commercialization of lasers that operate on femtosecond time scales. That's equivalent to $10^{-15}$ seconds, or 1 millionth of 1 billionth of a second.

"These laser pulses are very short in time, but have really high intensity," Daniel said. "At the femtosecond time scale, almost all motion is stopped, or frozen." By coupling the femtosecond laser to a high-speed camera, measurements can be performed thousands of times a second.

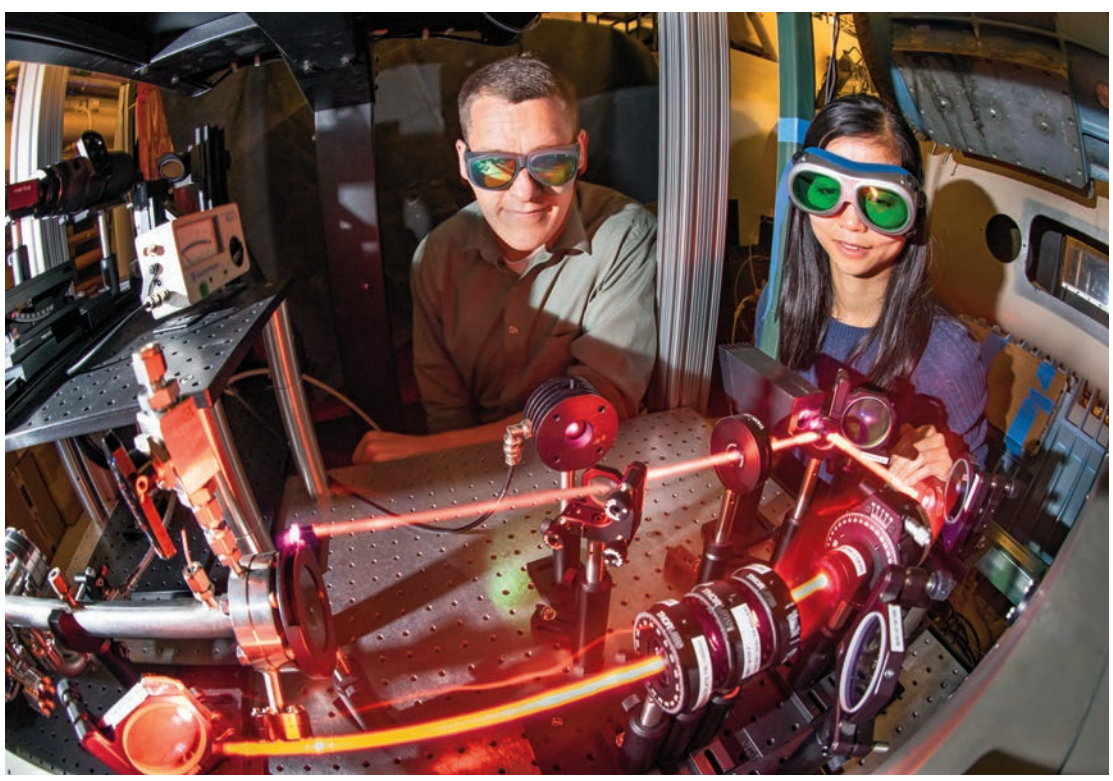
"This cutting-edge equipment allows Sandia to extract more data from each wind tunnel run than previously possible," Daniel said.

## Develop and validate

Sandia's hypersonic wind tunnel is relatively cheap to use in comparison with larger tunnels at NASA or the Air Force, but tests can go a long way to developing modeling and simulation capabilities. It blends the experimental with the computational to push the science forward, Steven and Daniel said.

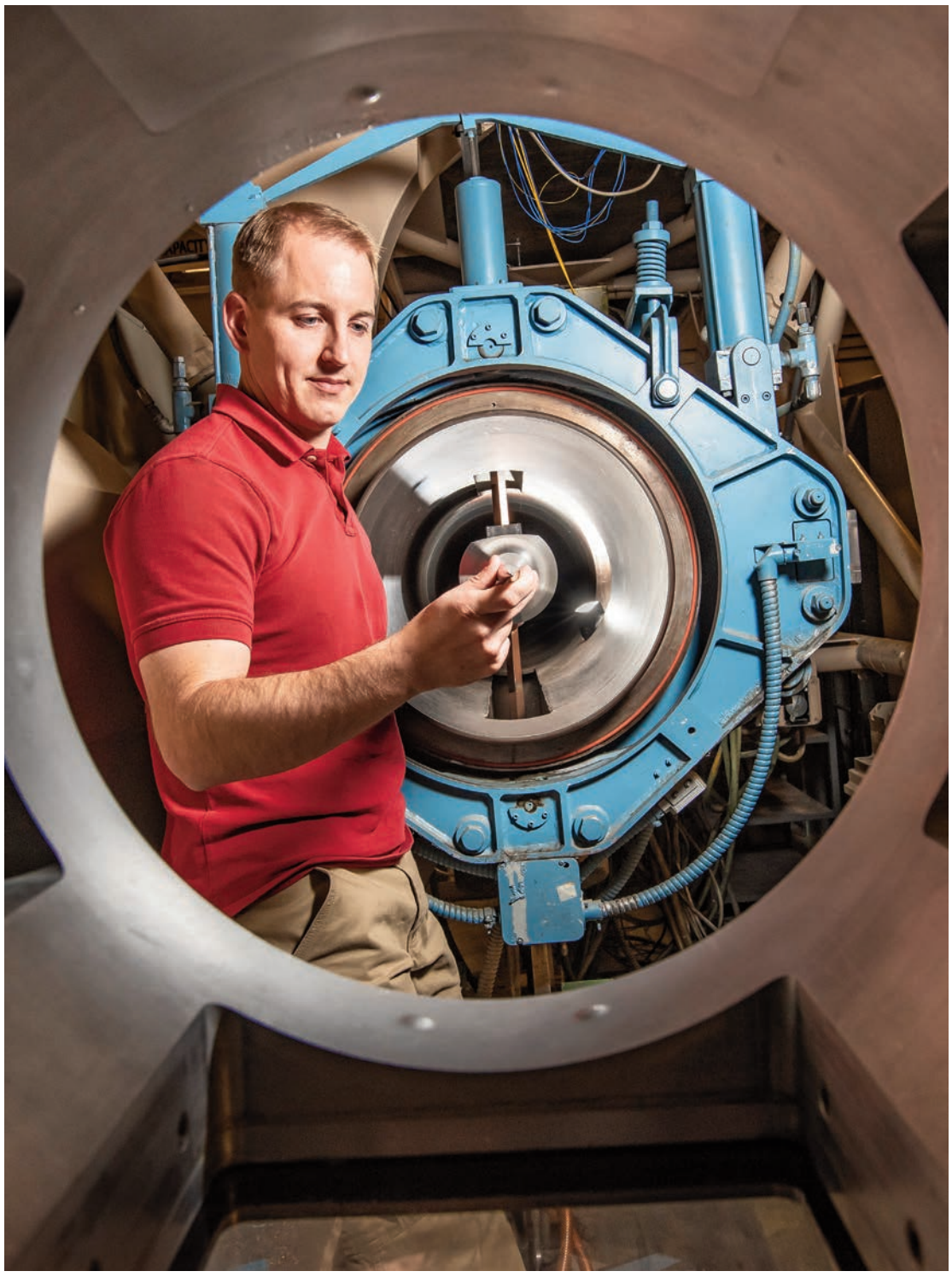
Sandia's wind tunnels have a long history, with the first built in 1955. Even with computational simulation dominating today's engineering practice, wind tunnels are key to aerospace technology.

"We are making more accurate measurements because we're always trying to push that capability," Daniel said. "The hypersonic wind tunnel and measurement science are important parts of research at Sandia. It's a proving ground for future capability."



LASER PRECISION — Mechanical engineer Daniel Richardson, left, and Yibin Zhang, a postdoctoral fellow, observe a laser that records measurements in the hypersonic wind tunnel.

TECHNOLOGISTS Seth Spitzer and Russell Spillers discuss a test installation in Sandia's High Altitude Chamber.



KYLE LYNCH, senior member of the technical staff, inspects a model installed into Sandia's Hypersonic Wind Tunnel.